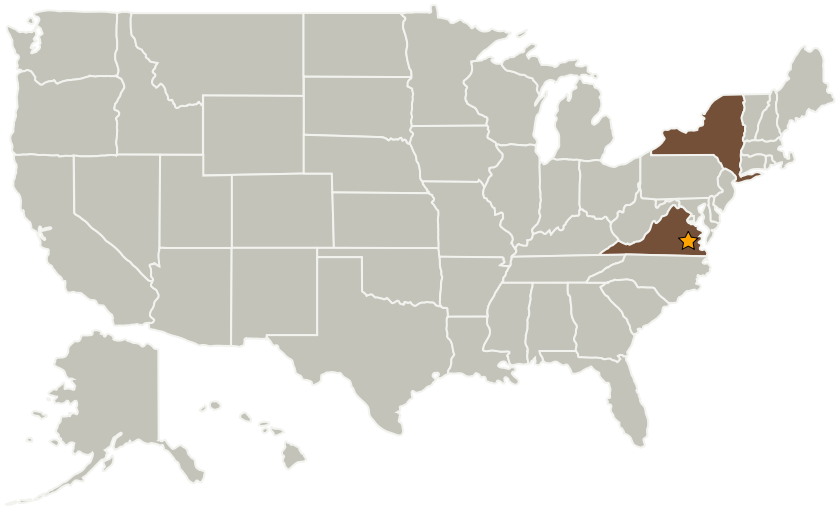
Accounting for Epistemic and Aleatory Uncertainty in Early System Design, Phase II

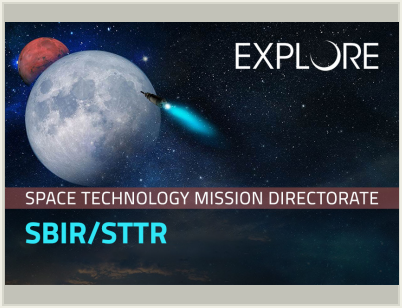
Completed Technology Project (2006 - 2008)

Project Introduction

This project extends Probability Bounds Analysis to model epistemic and aleatory uncertainty during early design of engineered systems in an Integrated Concurrent Engineering environment. This method uses efficient analytic and semi-analytic calculations, is more rigorous than probabilistic Monte Carlo simulation, and provides comprehensive and (often) best possible bounds on mission-level risk as a function of uncertainty in each parameter. Phase 1 demonstrated the capability to robustly model uncertainty during early design. Phase 2 will build on the Phase 1 work by 1) Implementing the PBA technology in Excel-mediated computing tools, 2) Fashioning an interface for these tools that enables fast and robust elicitation of expert knowledge, 3) Initiating the development of a library of such elicitations, 4) Demonstrating the application of the tools, interface and library in an interactive, distributed-computing environment, 5) Developing case studies, and 6) Creating tutorial documentation. Important applications of these new tools include the ability to rapidly and rigorously explore uncertainty regarding alternate designs, determine risk-based margins that are robust to surprise, and incorporate qualitatively described risks in quantitative analyses. This suite of capabilities is not currently available to systems engineers and cannot be provided by more traditional probabilistic risk assessment methods.

Primary U.S. Work Locations and Key Partners





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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Langley Research Center (LaRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Langley Research Center(LaRC)	Lead Organization	NASA Center	Hampton, Virginia
Applied Biomathematics	Supporting Organization	Industry	Setauket, New York

Primary U.S. Work Locations	
New York	Virginia

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX09 Entry, Descent, and Landing
  - TX09.4 Vehicle Systems
    - TX09.4.5 Modeling and Simulation for EDL